A New Class of High Z Nanocrystalline and Textured Oxide-Based Thermoelectric Material, Phase I

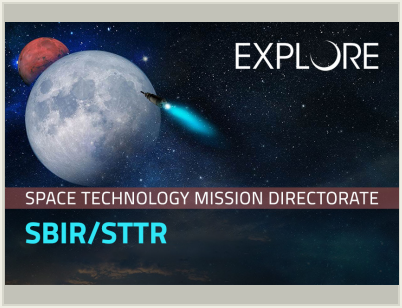
Completed Technology Project (2007 - 2007)

Project Introduction

We propose to develop high figure of merit (ZT) oxide-based thermoelectric materials. This will be accomplished by engineering a novel microstructure that will lead to reduced lattice thermal conductivity, a large Seebeck coefficient and high electronic conductivity. A new processing route to achieve the desired microstructure is proposed, which builds upon our core competency in nanomaterials synthesis and processing. The proposed oxide materials can be used at higher temperatures than currently available non-oxide based thermoelectrics. The Phase I effort, a collaboration with a leading thermoelectrics research group in the United States, will demonstrate the feasibility of fabricating a dense oxide leg with high ZT and conversion efficiency at elevated temperatures. Prototype thermoelectric devices using p- and n- oxide legs will be fabricated and tested, and efforts will be undertaken to transition the technology into the commercial arena, especially in industrial waste heat recovery.

Anticipated Benefits

With the advent of thermoelectric coolers and heaters for consumer applications, thermoelectric devices now have the potential to be used in technologically challenging applications, such as recovering industrial waste heat and utilization of waste heat in automotives. These applications demand low cost and durable materials that can be used at high temperature and in the presence of oxidizing/reducing environment. The proposed program will address this market need. Metal-based thermoelectric materials are currently used in RTGs in NASA spacecraft. The service life is fairly long since thermoelectric devices have no moving parts. Thermoelectric devices generate clean energy with high power density, and are easily scalable. The proposed program to develop novel oxide-based thermoelectric materials will enhance the capability of current RTGs, including allowing higher operating temperatures.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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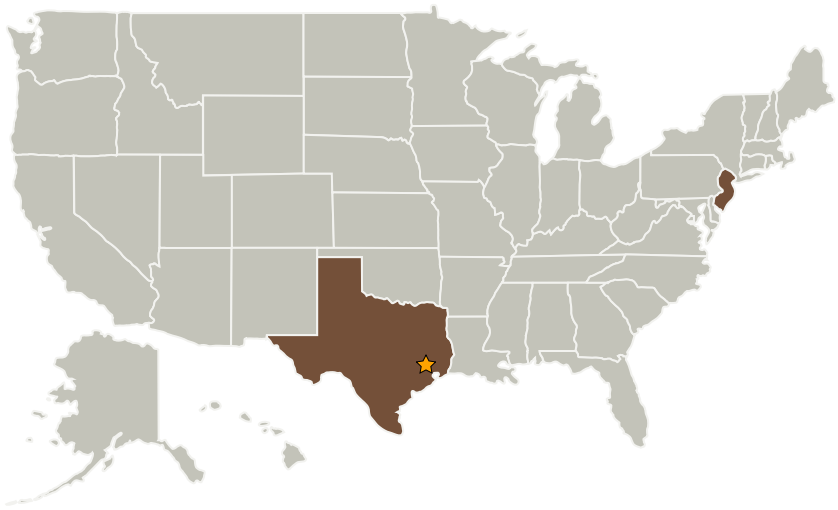
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
NEI Corporation	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Piscataway, New Jersey

Primary U.S. Work Locations	
New Jersey	Texas

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Giberto Varela

Principal Investigator:
Amit Singhal

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines